CHAPTER 7

STORAGE AFLOAT AND ASHORE

For stores to be useful to your ship they must be stored in such a way that both protects the stores from deterioration and at the same time protects the ship from any dangers presented by having these stores on board. In this chapter we will discuss some of the procedures to be followed when storing and handling stores both aboard ship and in warehouses. Safety procedures for materials handling were discussed in *Storekeeper 3 & 2* and should be reviewed with this chapter.

DEFINITIONS

Some terms used in storage should be defined before we go any further.

Warehousing—The scientific and economical receipt, storage, and issue of materials for safekeeping and rapid availability. This term refers to the detailed application of the principles of space layout and location of materials, or assignment of a particular item to a specific storage area at a terminal supply point.

Measurement Ton— Usually 40 cubic feet. This is also called a ship ton.

Measurement Cargo—A term used to describe cargo that measures more than 40 cubic feet per ton.

Deadweight Cargo— A term used to describe cargo that measures less than 40 cubic feet per ton.

Storage Factor— A term applied to cargo indicating the number of cubic feet of space occupied by one long ton of a commodity packed for shipment. It is arrived at by dividing the volume of cubic feet by the weight of cargo in long tons (2,240 pounds); that is, SF = V/W.

By knowing the storage factor of a commodity and the available cubic feet of storage, the total weight to fill this volume can be determined. As an example, a light tank, weighing 12.73 tons, that occupies a volume of 942 cubic feet would have a storage factor of:

$$SF = \frac{942}{12.73} = 73.9 \text{ or } (74)$$

In practice, extensive tabulations are available indicating the storage factor for almost any conceivable commodity or a representative group.

STORAGE AFLOAT

Storage of material afloat requires a knowledge of the factors to be considered in determining the storage location best suited for the stores, the precautions to be taken to make sure of the safety of both the stores and the ship, and the accessibility of the stores.

BASIC STORAGE CRITERIA

Materials in shipboard storerooms and other storage areas should be arranged to accomplish the following objectives:

- Make sure of maximum use of available space
- Provide orderly storage and ready accessibility
- Prevent damage to the ship or injury to personnel
- Reduce the possibility of material loss or damage
- Facilitate and make sure of issue of the oldest stock first (by the first in, first out [FIFO] method)
- Facilitate inventories

The preceding criteria and other instructions in this part provide basic guidelines that, if observed with a commonsense approach, will enable storeroom SKs to achieve optimum storage efficiency. (See the NAVSUP Publications 486 and 487 for specific storage instructions regarding subsistence and ship's store items respectively.)

STORAGE OF SENSITIVE MATERIAL

Certain materials because of their sensitive nature require controlled movement and storage conditions. Materials in this category that are most often encountered are discussed in the following paragraphs.

Chronometers

Chronometers are controlled equipage that, in end-use ships, are always turned over to the using department(s). When temporary storage ashore is required, such as during periods of either extended ship repair or deperming or flashing operations, chronometers will be turned in to the nearest chronometer pool for safekeeping.

Classified Material

Classified material will be stored and handled as per the supplement to the *Department of the Navy Information and Personnel Security Program Regulation,* OPNAVINST 5510.1.

Delicate Instruments

Delicate instruments that usually are expensive and easily damaged require especially careful handling and protective storage. Delicate instruments should be kept in a dry atmosphere, away from magnetron tubes or other magnetic devices. When possible, the storeroom temperature should be kept at 700°F or below.

Electron Tubes

Electron tubes are very easily broken and, therefore, must be carefully handled and adequately packaged when being stored or issued. Electron tubes susceptible to damage from moisture normally are packed in moistureproof barriers, frequently with desiccant (a dehydrating agent). Humidity indicator cards or plugs are provided for inspecting the effectiveness of the desiccant. Such indicators turn from blue to pink as moisture is absorbed. When the desiccant becomes pink, the desiccant must be replaced. The cartons, cushioning, and other protective packing or packaging in which the electron tubes were received should not be removed in storage unless it is absolutely necessary because of space limitations. When an electron tube container must be reduced in size, positive identity of the tube and as much of the packaging as possible should be retained. When space is not a factor, the original pack and packaging of an electron tube should be opened only if it is reasonably certain that the packaged tube is not the one identified by the stock number on the container. Electron tubes that are broken (or otherwise damaged) will be disposed of as per the *Naval Ships' Technical Manual,* chapter 9670.

RADIOACTIVE ELECTRON TUBES.— Instructions for the storage and handling of radioactive material, including radioactive electron tubes, are provided in the NAVSUP P-485.

MAGNETRONS.— Magnetrons are diode vacuum tubes in which the flow of electrons is controlled by an externally applied magnetic field. Special precautions will be taken to prevent magnetrons with permanently attached magnets from damaging magnetically sensitive instruments, such as compasses (electronic or mechanical) and wristwatches. (Wristwatches should not be worn when handling magnetrons.) Unshielded magnetrons with permanently attached magnets must be kept at least 50 feet away from aircraft or other vehicles with electronic compasses installed.

REPACKAGING.— Electron tubes unpacked for any reason except space limitation or use should be repacked in the original carton when possible. The tubes should be repacked with the same packaging and in the same position as that in the original carton. When repacking magnetrons or other tubes with attached magnets, there must beat least 4 inches between the center of the magnetic field and the outside of the container.

STORAGE OF HAZARDOUS MATERIAL

Certain materials have inherent properties that make them hazardous to personnel, the ship, or both. Most of these materials can be stored safely if the proper care is taken.

Oxidizing Material

Many shipboard fires with resultant fatalities have been attributed to improper storage or handling of oxidizing materials, particularly calcium hypochlorite. Oxidizing materials listed in the CHIL are identified by SMCC J. Nitric acid, a

strong oxidizer, will be stored in the acid locker. Oxygen, chlorine gases, and calcium hypochlorite will be stored as per the following paragraphs on calcium hypochlorite and compressed gases. All other oxidizers will be stored in a dry compartment, away from combustible materials.

Calcium Hypochlorite

Calcium hypochlorite itself is noncombustible; however, it is a strong oxidizing agent that can generate heat, liberate chlorine, and cause fire when stored in contact with paints, oils, greases, detergents, acids, alkalies, antifreeze, fabrics, and other organic and combustible materials. Calcium hypochlorite will be stored in bins or lockers labeled HAZARDOUS MATERIAL—CALCIUM HYPOCHLORITE in red letters on a white background. The bins or lockers will not be located in an area that is used for storage of combustible organic materials, or is adjacent to a magazine, or is subject to condensation or water accumulation.

Each bin or locker must be at least 5 feet away from any heat source or surface that may exceed 140°F and will contain no more than 48 6-ounce bottles (for potable water purification) or 36 3 3/4-pound bottles (for sewage waste treatment). The total quantity stored should not exceed the ship's average endurance level. On CLF ships, calcium hypochlorite carried as cargo should be stored in a separate enclosure constructed of steel or expanded metal with a secured door.

If calcium hypochlorite becomes contaminated, you can dispose of it in water or flush it into the drain or the bilge. Calcium hypochlorite is not a fire hazard when dissolved even in an oily bilge.

Drummed Products

Whether drummed products on board are flammable liquids or nonflammable material, the drum will be stored on end with the bung end up. An adequate identification of the contents must be legibly indicated on the side of each drum. If stored on the weather deck, they should be covered with a tarpaulin (when possible). Drummed products will be inspected at least weekly to make sure the bungs are tight and there are no leaks or corrosion.

Compressed Gases

Compressed gases must be stored on the weather deck unless the ship has below-deck storage spaces specifically designed for such material. Compressed gas cylinders will be stored vertically and securely (with valve protection caps in place), away from other flammable materials (especially grease and oil). When compressed gases are stored on the weather deck, the cylinders will be located as far as possible from navigation, fire control, or gun stations and will be protected from direct rays of the sun, or accumulation of snow and ice. When compressed gases are stored below decks, any leaking fumes must be prevented from entering ventilation air intakes leading to working or living spaces. Since there usually is some gas remaining in most cylinders considered to be empty, "empty" cylinders will be stored and handled with the same precautions as full cylinders. Compressed gases, particularly the flammable and explosive gases, must be handled with extreme care. Some general rules for handling compressed gas cylinders are as follows:

- Take every precaution to prevent cylinders from being dropped or forcefully struck against hard surfaces (including other cylinders). Do not tamper with the safety devices in cylinder discharge valves and, when cylinders are not in use, be sure the valve protection caps always are securely attached. (If the valve of a compressed gas cylinder should be snapped off, the released energy would cause the cylinder to behave as a missile. For example, a cylinder that is pressurized to 2,200 pounds per square inch [psi] can travel 2,600 feet in free flight and, in a confined space, it could be disastrous.)

- Prevent cylinders from contact with fire, sparks, or electrical circuits. (An exploded steel cylinder would have the same destructive effect as an exploded bomb.)

- Do not drag or slide cylinders required to be moved. Secure and move them in hand trucks that meet the criteria prescribed in the *Naval Ships' Technical Manual,* chapter 9230. If suitable hand trucks are not available, tilt the cylinders and roll them on the bottom edge.

- Secure cylinders in a cradle, pallet, or rack when they are loaded or off-loaded with a crane or derrick. Never hoist cylinders with electromagnets or with hooks or line attached to the valve protection cap.

- Do not alter or deface the numbers or other markings on the cylinders; do not add markings without approval of the engineer officer; and do not issue cylinders if their contents cannot be identified.

Detailed information relative to the storage, handling, and use of various types of compressed gases are contained in the *Naval Ships' Technical Manual,* chapters 670 and 9230. Information pertinent to especially hazardous gases commonly used by ships is provided in the following subparagraphs.

ACETYLENE.— Acetylene is inherently unstable and may explode when subjected to heat or shock, or upon contact with chlorine or certain metals such as copper, silver, and mercury. Therefore, acetylene must be stored separately from oxygen or any other materials with which it forms an explosive compound; the gas must never be allowed to escape into an enclosed area; and the cylinders must be protected from flames, sparks, lightning, and static electricity. Testing for suspected leaks should be done with soapy water.

In moderate concentrations, acetylene may act as an intoxicant. In higher concentrations, it will cause unconsciousness and, ultimately, asphyxiation. Some grades of acetylene also contain many impurities. Therefore, breathing of acetylene in any concentration for any length of time must be avoided.

Acetylene in cylinders is dissolved in acetone which has a tendency to flow into the valve if the cylinders are stored horizontally. For this reason, acetylene must be stored and used only in an upright position, valve end up. When it is known or suspected that acetylene cylinders have been stored on their sides, they must not be used until they have been in a vertical position for at least 2 hours.

OXYGEN AND CHLORINE.— Oxygen and chlorine are oxidizing gases that strongly support combustion because they can burn without air. (Chlorine is also poisonous.) Oxygen and chlorine cylinders must be stored on the weather deck, or in a separate watertight storeroom that has at least one compartment between it and any space that is used for the storage of combustibles such as flammable liquids or gases, ammunition, paint, gasoline, and oil.

NONFLAMMABLE GASES.— Helium, nitrogen, carbon dioxide, and argon are nonflammable gases that because of their inert characteristics may be stored with flammable or oxidizing gases. However, since these nonflammable gases will not support respiration (a sufficient concentration in a closed space will cause asphyxiation), they must be stored on the weather deck or in other well-ventilated spaces.

AEROSOL PRODUCTS.— Aerosol products are liquids, solutions, or powders suspended in a gas propellant and contained in dispensers equipped with release valves. Containers of aerosol are used for the disposal of paints, enamels, lacquers, insecticides, silicones, rust preventives, and so forth. The aerosol propellants may be low boiling halogenated hydrocarbons or other hydrocarbons such as liquified propane or isobutane. Aerosol cylinders will burst if exposed to heat sources in excess of 120°F and are prone to leakage if subjected to impact. Aerosol propellants are extremely flammable and, in sufficient concentration, can be anesthetic or asphyxiating. Aerosol products, therefore, should be stored in the flammable liquids storeroom, or in cabinets away from oxidizing materials; and mechanical ventilation should be used, when necessary, to remove accumulated vapors.

Flammable or Combustible Material

Flammable liquids have a flash point of 100°F or below; combustible liquids, greases, and pastes have a flash point of 200°F or below. Items that are flammable or combustible include the following:

- Gasoline, oils, kerosene, and other petroleum products
- Chemicals
- Stencil paints, marking inks, and printer's ink
- Solvents, thinners, primers, compounds, varnishes, and lacquers
- Alcohol, acetone, ether, and naphtha
- Greases and pastes

Except for drummed petroleum products, which may be stored in racks on the weather deck as per the *Naval Ships' Technical Manual,* chapter 670, flammable liquids and other flammable or combustible material will be stored in the flammable liquids storeroom.

Acid

Liquid acid, unless classified as safe material in the *Naval Ships' Technical Manual,* chapter 670, should be stored in an acid locker. If an acid

locker is not available, acid bottles must be stored in the flammable liquids storeroom; but, in this case, the deck and the lower part of the bulkhead must be covered with a watertight rubber lining, and a label inscribed ACID BOTTLE STORAGE in 3/8-inch letters must be securely attached to the outside of the storeroom door. Corrosive acids are acute fire hazards and, therefore, should be stored separately from oxidizing or flammable materials. Corrosive acids (or vapors) must not be allowed to come in contact with the skin or eyes. SKs who store or issue these acids should wear rubber gloves, rubber aprons, and goggles (as necessary) to protect themselves and their clothing from acid burns.

METALS

Bar stock, sheet metal, angle iron, tubing, pipe, and other metals must be kept in racks specifically designed for the storage of such metals. The racks should be installed fore and aft to minimize shifting of the stored material when the ship is underway. Polished sheet metal and aluminum tubing are easily scratched and dented and, therefore, must be carefully handled and secured in the rack. Gloves should always be worn when handling metals to protect the hands from injury and to protect certain metals (with polished surfaces) from acid stains that can be caused by perspiration. When possible, noncorrosive greaseproof material will be used to separate dissimilar metals required to be stored together, inasmuch as direct contact between different metals may cause corrosion due to electrolysis.

Since any required re-identification of metals by chemical analysis is often impractical or too costly, many metals that lose their identification markings are likely to become unusable assets and, in effect, lost to the supply system. Positive identification of metals to be used in high-pressure steam systems (or other critical shipboard systems) is absolutely necessary. Therefore, it is essential that the correct NSN, specification markings, and the manufacturer's markings (when appropriate) are legibly indicated on each piece of metal in storage and on each piece of metal issued for use.

SHELF-LIFE MATERIAL

Consistent with established Department of Defense policy concerning the identification, control, and use of shelf-life items, procedures for the proper management of such material are prescribed in the following paragraphs. These procedures are prescribed to reduce the large financial losses experienced throughout the supply system incident to nonuse of deteriorative items before their shelf-life expiration dates and to make sure overaged materials (that may be ineffective or unsafe) are not installed in shipboard equipments. Effective attainment of shelf-life material control depends primarily on the efforts of storeroom personnel.

To facilitate periodic screening of shelf-life items, see the NAVSUP P-485. Applicable stock records (and NAVSUP Forms 1075, if maintained) should be annotated or otherwise identified to indicate the proper shelf-life code. Shelf-life codes currently assigned to applicable NSNs in the ML-N are listed in the appendixes of the NAVSUP P-485.

Marking of Stock

Per established supply distribution systems procedures, shelf-life items issued by ashore supply activities or delivered direct by contractors will be marked (on the unit package, exterior container, or material itself) as follows:

TYPE I SHELF-LIFE ITEM

DATE (MANUFACTURE/CURE/ ASSEMBLY) _____

EXPIRATION DATE _____

or

TYPE II SHELF-LIFE ITEM

DATE (MANUFACTURE/CURE/ ASSEMBLY) _____

INSPECTION/TEST DATE _____

EXTENDED EXPIRATION TEST DATE _____

Type I (nonexpendable shelf-life) items are those for which shelf-life action code UU is indicated on the latest applicable NAVSUP Form 796. Refer to the NAVSUP P-485. All other shelf-life action codes except 00 (nondeteriorative) apply to type II (extendable shelf-life) items. Current onboard stocks of shelf-life material should be screened and, insofar as practical and necessary, each item should be marked to show the type I or type II shelf-life data described herein.

Shelf-life items that are not marked with any date from which shelf life can be determined and that have an extended cost of $50 or more will be reported by speedletter to the cognizant inventory manager, via the TYCOM, with a request for disposition instructions. For each item, the report will contain the NSN or part number, item description, quantity, unit of issue, unit price, extended unit cost, supply source (if known), estimated date of receipt on board, and all external markings obtainable from each unit package or container.

Control and Utilization

In addition to the proper identification of shelf-life stock in applicable inventory locater records, the procedures in the following paragraphs are prescribed for effective control and maximum utilization of shelf-life items before their expiration dates.

Packaging, Preservation, and Storage

Shelf-life material will be inspected upon receipt to make sure it is packaged and preserved adequately and should be stored in spaces that are least likely to cause its deterioration. The coolest and driest space(s) available should be used for the more deteriorative materials such as dry cell batteries, aluminum electrolytic capacitors, chemicals, rubber products, and so forth. Storage can be arranged to make sure of issue of the oldest stock first. To facilitate periodic screening, shelf-life items should be consolidated in a readily accessible area whenever possible.

Periodic Inspection

Shelf-life material should be inspected periodically (as frequently as necessary, according to shelf-life codes) for condition and expiration dates. When a multiple quantity item is inspected, units with different expiration dates can be rearranged, if necessary, to place units with the earliest expiration date in front of the others.

Expired Type II Shelf-Life Items

Expired type II shelf-life items can be restored (when within the ship's capability) per applicable shelf-life action codes in the ML-N or the cognizant inventory manager's instructions. Technical assistance will be obtained from other departments, as required. The expiration dates on the stock labels of restored items will then be extended, as appropriate. Expired type II shelf-life items that are not within the ship's capability to restore can be turned in to the nearest ashore supply activity.

Expired Type I Shelf-Life Items

Expired type I shelf-life items normally will be disposed of by removal from stock and destruction, unless the overaged items can be used safely for secondary purposes that do not require the material to be ready-for-issue condition.

Inventory Review

The shelf-life item inventory should be reviewed systematically in comparison with anticipated requirements to make sure of timely turn-in of those items that the ship is unable to restore or to use, by or before the material expiration dates. The newer rather than the older stock of an item always will be turned in unless extenuating circumstances are involved that render such action impractical. Type I shelf-life material will not be turned in to supply activities in the United States including Hawaii if the extended cost of the item is less than $50, or the remaining storage life is less than 3 months. Type I shelf-life material will not be turned in to supply activities in Alaska or overseas bases if the extended cost of the item is less than $100 or the remaining storage life is less than 6 months. Such material should be retained on board and used, if possible, before its shelf-life expiration date.

Critical Shelf-Life Items

Instructions contained in the previous paragraph do not supersede existing directives for disposition of critical items. Disposition of shelf-life items designated as critical can continue to be effected under pertinent directives issued by the cognizant inventory manager.

STOREROOM MAINTENANCE AND SECURITY

The SK in charge of a storeroom (or group of storerooms) is responsible for the cleanliness, orderliness, material condition, and the security of his or her assigned spaces. The supply officer, the stores officer (depending on the type of ship), and the leading storeroom SK are responsible to make sure all required storeroom maintenance

and security tasks are regularly and properly performed.

Cleanliness and Orderliness

Cleanliness and orderliness are important to proper storeroom maintenance, the efficient storage and issue of materials, and the safety of your personnel. The supply officer or you, as the leading SK, should make sure your storeroom personnel are taught good housekeeping practices, and they conduct a field day in their respective spaces before each scheduled zone inspection. They should pay attention to bins, shelves, ventilation outlets, any overhead ledges, and also to deck areas partially blocked by stores, bins, or racks. Before securing the storerooms at the end of each workday, the decks should be swept; all cleaning materials, tools, and loose gear put away; the lights turned off; and all trash removed and disposed of.

Material Condition of Spaces and Fixtures

The material condition of storage spaces (and of any installed electrical fixtures, ventilation ducts, steam or water pipes, valves, watertight fittings, bins, or racks) should be checked daily either by you or the SKs in charge of these spaces. The supply officer or a representative should inspect these same spaces at least weekly. Your storage spaces should also be regularly inspected by your departmental or work center damage control petty officer (DCPO). The DCPO is primarily responsible for checking the watertight integrity and damage control equipment such as battle lanterns, fire extinguishers, and fire hoses, just to name a few. Any deficiencies that are noted by the SK in charge or the DCPO should be promptly reported to you or the supply officer. You should then request the department head (usually the engineer officer) to have the deficiencies inspected and corrected. SKs in charge should be present during inspections and repairs in their respective storerooms. Upon completion of jobs, they should promptly notify you so that you can inspect the work and notify the supply officer.

Improvements of Spaces and Equipment

When the SK in charge of a storeroom considers that structural alterations or the installation or modification of storage aids is necessary or desirable, he or she should submit recommendations to the supply officer via the chain of command. If the recommended changes can substantially increase efficiency, material protection, or safety, the supply officer should submit a work request or other actions as may be necessary to effect the improvements.

Storage of Personal Gear

Supply personnel love to store their personal gear in either their work spaces or in the storerooms. There should not be any personal gear (no matter whose it is) stored in any supply department spaces without written permission from the commanding officer.

Daily Report of Security

Each day after the storerooms have been secured, the duty SK should report their security to the supply duty officer. Departmental security reports, to the command duty officer, should be made at the time specified in the ship's plan of the day. If the storerooms are not secured by the time departmental reports are made, the command duty officer should be advised of the reason why and when they will be secured.

Securing for Sea

Upon notification that you are preparing to get underway, the storeroom personnel should start the day securing all the storerooms and equipment. When all supply department spaces have been properly secured, you should notify the supply officer that every space is ready for sea. The supply officer should then make his or her departmental readiness for sea report to the officer of the deck.

UNDERWAY REPLENISHMENT

Underway replenishment is the art and science of supplying ships at sea with fuel and stores. This maneuver, one of the major achievements of Navy supply and logistics, involves techniques developed within comparatively recent times that are still undergoing refinement.

The merits of underway replenishment are such that its use has become commonplace, and it is now difficult for supply personnel to conceive of conditions in which it is necessary for a ship to return to port to take on needed fuel and supplies.

The primary value of underway replenishment is realized during wartime, since it enables a combat ship to remain at sea for an indefinite period of time. It also has peacetime advantages, as do most maneuvers developed to enhance combat efficiency. It provides valuable training of personnel in the complex procedures of supplying several vessels simultaneously while they are proceeding at reasonable speed. Thus, in general, underway replenishment serves a dual purpose—provides ships with materials needed in any event and trains the crews of discharging and receiving ships in the procedures essential in wartime in which fuels and stores are transferred at sea.

Senior SKs play important parts in underway replenishment. They work closely with other senior petty officers and most of the officers of the supply department in planning the replenishment procedures and in supervising the work in progress. It is principally with regard to planning that the background and knowledge of the SK1 and SKC are essential. In this respect, the function of the senior petty officer differs from that of the lower-rated enlisted personnel involved, since the latter seldom participate in planning and rarely have an opportunity to take a broad and comprehensive view of the operation as a whole.

This chapter focuses your attention on the essential elements in planning and executing replenishment on board a typical ship (an aircraft carrier) when receiving supplies at sea. No effort is made here to provide a complete outline or to list all the numerous steps in detailed form, since the procedures of receiving stores underway are not standardized to the point that an acceptable blueprint can be furnished from outside. Rather, in the following pages, emphasis is placed on the factors that must be considered in formulating local plans for efficient functioning under local conditions. These factors include the coordination of various departments, the stations to be manned, the amount of stores anticipated, the personnel and equipment needed, and the special procedures and safety precautions normally used during replenishment operations.

When all necessary factors have been considered and all essential planning has been executed skillfully, the underway replenishment operation is a splendid and impressive spectacle featuring teamwork, speed, and precision. On the other hand, when the operation goes wrong because of inadequate planning or from other causes, the situation can become a nightmare of confusion in a matter of minutes, and the resulting knots of disorder may require many hours of hard work to untangle.

TYPES OF STORES ANTICIPATED

The number of stations that must be manned and used depends to a considerable degree upon the amount and kind of stores anticipated. A few days before replenishment, the transferring ships notify the recipients as to the nature and amount of stores to be transferred. The figures given are in most cases loose approximations and can be used as rough estimates for planning purposes. A safe rule of thumb is to plan for a one-third excess over the tonnage expected, and planners should assume that at least some of every category of material is to be received. A replenishment plan must be sufficiently flexible to make sure its usefulness is not destroyed by sudden, unexpected changes in quantities and types of stores received. Personnel must be on hand to handle all types of material at once.

Especially important is a knowledge of the quantity and type of dangerous and semisafe material to be received. Adequate flammable storage space must exist to accommodate all such material to be received. Special procedures should be setup so that this material can be taken directly from the receiving station to the paint and flammable liquid storeroom and not be allowed to accumulate on deck. An inspection should be made of the paint and flammable liquid storerooms to make sure they are in readiness to receive the material without any great amount of time consumed in rearrangement of stock.

Each type of stores is handled in a slightly different manner and is sent to different storage locations. Plans for the replenishment must take the peculiar characteristics of all types into consideration. Some of the most important aspects of handling each category are discussed in the following paragraphs.

General Stores

General stores received during replenishment normally include the so-called HULL items. There are enormous amounts of bulky materials such as rags, toilet paper, brooms, swabs, and paint, all of which are difficult to handle. Many of the items are almost impossible to handle mechanically. Sorting and checking must be done under your supervision with junior SKs and strikers assisting and directing the actual movement into storerooms.

Dry Provisions

Dry provisions represent a large portion of any replenishment, since ships' personnel complements consume food by the ton. This group of material is the easiest to handle and sort. Most of the items are shipped in sturdy fiberboard cartons and the material moves on conveyors easily; it stacks neatly on pallets; and the individual boxes are light enough to be handled by one person. Checking and sorting are done in all cases by senior Mess Management Specialists, with such assistants as are necessary. Particular care must be exercised in handling items in bags such as flour and sugar.

Fresh Fruits and Vegetables

Fresh provisions are somewhat difficult to handle and to move to the reefers. This is particularly true on those ships having reefers located in what appears to be the most inaccessible spots possible. The process of striking fresh provisions below can become bogged down on these ships and must be monitored carefully.

If potatoes are to be stored on sponsons, they should be sent there directly. Manual handling of potatoes is the usual rule and should be taken into account when the working party is assigned—persons handling heavy boxes of potatoes need to be relieved sooner than others in the working party.

Medical department personnel should be on hand to inspect fresh provisions for quality and to recommend survey when appropriate. Mess Management Specialists should be stationed in such places as necessary to detect spoiled produce before too much labor is wasted in moving it below.

If the working party is not adequately supervised, considerable waste may be encountered through the breaking open of crates to get fruit to eat on the spot. However, the damage can be reduced to acceptable limits by opening a few crates for consumption by the working party. Partially opened crates not only waste the food that is spilled, but contribute to the more serious danger of people slipping on the juicy pulp on the deck. Sand or other material should be on hand to sprinkle over wet decks to prevent slipping.

Frozen Provisions

The most important requirement when moving frozen provisions is speed. Particularly in hot climates where steel decks become very hot, frozen foods may be reaching the safe limits of out-of-refrigeration time when they are received and should be moved into the refrigerators with a minimum of wasted motion. Monetary loss on spoiled frozen foods is high, due to the greater processing cost. Checking and sorting should be done by Mess Management Specialists.

Working party units assigned to handle frozen foodstuffs should be advised in advance to wear gloves, if they are to handle the boxes manually. The gloves should of course be reasonably clean, and it should be possible to have canvas work gloves issued for this purpose from supply.

Accountable Stores

Receipt of fairly large amounts of ship's store stock is routine on a replenishment. Clothing items are normally received in small lots. The bulk of the shipment consists of canned drinks, confections, and toiletries. The ship's service division should be represented by responsible people at each loading station to take charge of such accountable material as soon as it is received. Accountable items are sometimes found mixed in with general stores or food items, in spite of the care exercised by shipping and handling activities.

Virtually all items in this category are highly pilferable, and every person in the supply department should assist in preventing theft. While relatively few people attempt to appropriate, there are always a few who try to misappropriate a case of candy. If the shipment is large, responsible petty officers from other supply divisions may be used as escorts for the working party carrying the material into storerooms, or for watching conveyor tracks or chutes. Every foot of the entire route followed by accountable stores must be in full view of a responsible petty officer at all times.

DEPARTMENTAL RESPONSIBILITIES

Replenishment at sea comes very close to living up to the hackneyed phrase "an all hands evolution." With the possible exception of a major ammunition movement, it involves more people directly and physically than any other operation. Material is removed from holds in the delivering ship, loaded into cargo nets, and sent across to the receiving ship at rates of well over a hundred tons per hour. It must be removed from the landing area as fast as it arrives and struck below at approximately the same rate. With all this activity concentrated into a short time the efforts of all these people must be coordinated carefully to avoid chaos.

Overall control and coordination are vested in the executive officer. The executive officer usually holds a meeting of department heads, at which time the responsibilities of each are outlined. The detailed planning and the day-to-day coordination with other departments are then normally turned over to the supply officer. Thereafter, the executive officer is kept informed of progress in planning and takes an active part only if difficulties arise that cannot be handled at the lower level. During the replenishment the executive officer remains on the bridge, and the supply officer is in charge of the movement of stores once they are received.

While several departments other than supply are actually concerned with replenishment, only weapons and air departments visibly take part. These departments are discussed separately. Operations is responsible for mail being transferred and for transfer of personnel when required. Engineering personnel man elevator pumprooms, grant permission to open hatches as required, transfer movies, and make sure sound-powered telephones are available and working. The aircraft intermediate maintenance department is responsible for maintaining forklifts and other materials-handling equipment. Although they have additional duties when transfer of fuel or gasoline is involved, these operations are not a direct concern of the SK.

WEAPONS

The weapons department normally has a representative attend at least one of the later planning conferences discussing replenishment. This department is responsible for physically loading the material on board the receiving ship (except during vertical replenishment), for enforcing all safety precautions at replenishment stations, and for making sure all nets, slings, pallets, and other handling material belonging to the delivering ship are returned. If weapons department elevators are used in striking stores below, weapons department personnel operate them. The weapons department representative is primarily concerned with the number of tons to be received and the rate at which the material comes aboard.

AIR

The air department representative to the planning conference is mainly interested in the amount of clear deck space required and the elevators that must be manned. During vertical replenishment operations, air department personnel also provide direction to the helicopter in spotting each net load.

REPLENISHMENT PROCEDURES

Replenishment procedures encompass several areas that require a senior SK's knowledge and attention. These areas of required knowledge include the different stations used during replenishment, the personnel required, the equipment to be used, and the actual procedures used for the receiving, strikedown, and transfer of accountability.

Replenishment Stations

A replenishment station is any location where some significant action is taken on the stores being received. The station can be divided into three general groups—receiving, sorting, and striking. Stations within a group cover the same function regardless of location.

Figure 7-1 shows the location of replenishment stations on a typical large carrier. Receiving stations No. 1 and No. 2 are on elevators No. 1 and No. 3 respectively; the elevators being at hangar deck level. The third receiving station, normally used during vertical replenishment operations, is on or in the vicinity of the No. 2 elevator. Your newer aircraft carriers will have four elevators.

Sorting stations are close to the receiving stations where net loads may be towed by tractor or delivered on roller conveyors. At this point, stores are sorted and palletized on the basis of strike area (station). Figure 7-1 shows major strike areas where mechanical equipment is available; however, strike areas are located anywhere in close proximity of the ultimate storage area of significant amounts of materials.

RECEIVING STATIONS.— The first group includes all the receiving stations, the sites where the material first lands when it is received on board. Most receiving stations are located on the hangar deck. Ship designs vary, even within a class, with consequent variations in number and locations of receiving stations.

Elevators No. 1 and No. 3 remain lowered to hangar deck level; helicopter receipts are received on elevator No. 2 at flight deck level. The use of elevators as receiving stations is advantageous in that adequate space is available for handling stores.

Material is under the control of the weapons department (air department in the case of vertical

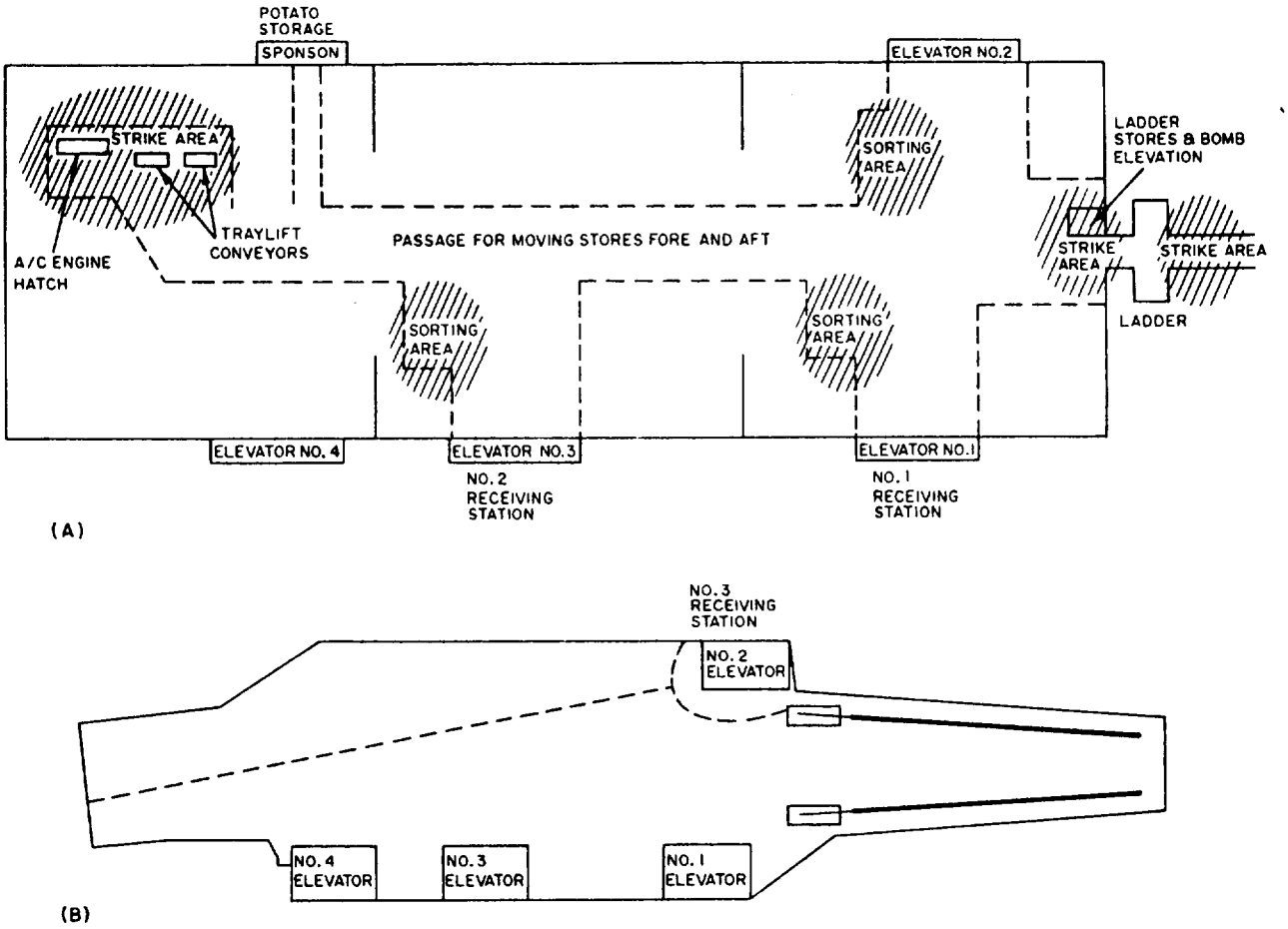

Figure 7-1.—Carrier deck plans (A) hangar deck; (B) flight deck.

replenishment) until the nets are detached from the transfer rig at the receiving station. At that moment the stores become the responsibility of the supply department. They must be removed from the receiving station as quickly as possible. The time interval available is the time required for the hook to travel to the transferring ship, pick up a loaded net, and return—a matter of moments. Material received by helicopter must be moved into position on the elevator quickly and the elevator promptly lowered to the hangar deck, cleared of stores, and promptly raised to the flight deck for the next load.

SORTING STATIONS.— The second group is composed of the sorting or segregation stations, where the material is separated by type and storage destination. These stations may be located at any point, depending upon local conditions. Sorting necessarily requires a fair amount of space, especially since there may be temporary delays while unit loads of one item are assembled. The main consideration in assigning locations for sorting stations must be that no time or effort is wasted. If the storerooms are located in other parts of the ship, sorting must be done on the hangar deck. Material received by helicopter on the flight deck is usually shunted promptly to a hangar deck sorting station.

Some ships are designed so that foodservice storerooms are accessible from the messdeck. On these ships, provisions may be shunted directly below to the messdeck before sorting.

STRIKE STATIONS.— The strike stations, the third group, are the access hatches where the material is moved below decks. Included in this group are the ammunition elevators, hatches where pallets are lowered by electric hoists, and hatches where material is passed down by hand by sliding on board or down metal chutes or belts.

This group is critically important. Access hatches must, of course, remain open until the stores are struck below. A ship is in danger whenever the ship is unable to seal off all compartments within a very few minutes—impossible to do during a replenishment. Prolonging the striking phase, therefore, exposes the entire ship and crew to danger for an unnecessarily longtime. This is unacceptable to any responsible command.

Personnel Requirements

The number of personnel required for a replenishment depends primarily upon three variables—the number of stations to be used, the kind and amount of stores to be received, and the equipment available that serves to reduce manual labor.

It is probable that the ship has a local instruction that lists the number of personnel and the type of equipment required at each station. The instruction should be studied carefully. If it appears to be inadequate or incorrect, the planning group should not hesitate to recommend changes based on careful analysis of each provision in the instruction.

A replenishment plan, published before the operation, should assign units to stations, with deck and frame numbers listed where the personnel are to assemble.

PETTY OFFICERS.— Petty officers from the department furnishing personnel for the working party are the backbone of any good replenishment. Orders should be issued through them for their personnel. Petty officers are required at a ratio of 1 for each 10 persons in the working party. These 10 persons should be under the petty officer's control as a team at all times and the petty officer should be responsible for seeing that they remain on station until dismissed. Ideally, the petty officer should be personally acquainted with each member so that the petty officer does not have to keep track of one or two strangers in a large group.

There is a tendency for departments to furnish the petty officers who can best be spared from their primary duties. This usually means that a large majority of them are new third class petty officers. Many of these people are excellent petty officers, but in the group there may be many who lack supervisory experience. The supply officer should be tactfully reminded early in the planning stages to bring up the subject with the other heads of department and to insist that only qualified petty officers be furnished. It is to the advantage of the other departments to expedite the replenishment, and the better qualified the personnel they send, the better the chances for an early completion. Some ships specify in their replenishment plan that team petty officers be second class petty officers or above.

WORKING PARTY.— The number of people required is fairly simple to compute. Each station that is to be used should be considered separately, taking into account the amount of stores to be handled at the station and the equipment that is to be used there. Heavy and awkward materials that must be handled at high speed (such as potatoes) require that people be relieved frequently. Relief should also be provided for any team or teams who are to be on station for an unusually long time. Tired personnel are apt to have accidents and materially slow the operation, Relief should be by rotation of units with, in the most cases, the relieved unit standing by to take over at the end of the rest period. Considerable team competition can sometimes be generated that speeds movement of the material and reduces the effect of fatigue.

If material is to be removed from receiving stations by towing the loaded cargo nets to the sorting stations, one team should be assigned to each receiving station to pick up items that spill out of the nets. This occurs frequently enough so that provisions should be made in advance to take care of it. These teams may be secured as soon as the last load of material is aboard, or maybe shifted to another location as a relief party. The team petty officer should know in advance what is required.

ASSIGNMENT OF SUPPLY PERSONNEL.— As stated before, a substantial number of the officers and petty officers in the supply department must be used during a replenishment. Some supervise, some check and sort the various kinds of material received, and some are available to accept accountable stores.

Supervisors.— In planning the assignments of supervisors for the replenishment, particular attention should be given to the possibility of causing confusion through oversupervision. Competent officers and petty officers leave their own personal mark upon whatever they do. This is done quite unconsciously in most cases and consists of doing things in their own particular way. Too many strong personalities operating in a given

area, with each trying to do things his or her own way, result in conflicting orders. It is far better to break the functions down and give each supervisor clear responsibilities within a definite area. Holders of adjacent territory then tend to keep the supervisor within bounds.

A special chain of command should be established for replenishments. At the top is the supply officer who doubtless observes the operation from various spots on the hangar deck. The supply officer may need runners to keep informed of the replenishment operation.

The next level is the junior officers of the department, each with responsibility in a particular area. If there are not enough areas to use the available junior officers, some of them may be designated by the supply officer as observers who are assigned to look for ways to improve future replenishment and be on the alert to spot any unsafe practices or potentially dangerous situations. If any unsafe conditions are observed, they should be called to the attention of the responsible supervisor at once and brought up later at the critique. Rotation is usually practiced so that they may take part in the next replenishment. If there are not enough junior officers to fill the required posts, the most senior petty officers are assigned to fill in as necessary.

The third level consists of senior petty officers who are assigned to specific functions within the areas supervised by the junior officers. The functions assigned to each should be clearly defined in advance. Each should be responsible only to the officer in charge of that area.

Other levels may be established if local conditions warrant. Care should be exercised that each person in each level answers only to the person directly above, and each should know who his or her immediate senior is.

Checkers.— Checkers are assigned to check and sort only. These tasks occupy so much of their time that they are unable to supervise any other activity effectively. They confine themselves to directing separation of different items, leaving the movement and storage of the items to the personnel assigned supervisory duties. The fact that a person assigned to check or sort is senior to the person assigned to supervise general movement of material does not serve to negate the authority of the supervisor whose position is military rather than professional.

Each station where material is checked and sorted should be manned by personnel qualified to handle each type of material reasonably expected to be encountered there. If provisions are segregated on the messdecks, there is obviously no point in having AKs or SHs standing by to accept material that is never delivered.

During a replenishment, supply department personnel may be assigned as follows:

JUNIOR OFFICERS may be assigned on the basis of one to each of the three or four hangar bays and one to the flight deck, if that station is to be used. Usually an officer is also assigned to each of the forward and after messdecks if provisions are to be struck below from these points.

PETTY OFFICER SUPERVISORS should be assigned smaller areas. For instance, one person should have charge of movement of material from receiving stations No. 1 and No. 2 to the sorting area. Another similar assignment should be made for the flight deck receiving station, if used, and a third person should be assigned to movement of material from the sorting station to strike stations. Each strike station should have a supervisor.

Checkers should be assigned to each sorting station to direct segregation of material. They must be thoroughly familiar with the material and storage locations. Movement of material out of the sorting station should be the province of the supervisor.

Movement of material from the flight deck should be the responsibility of the supervisors assigned to the flight deck. When material has been loaded onto elevator No. 2 and lowered to hangar deck level, it then becomes the responsibility of the hangar bay No. 1 supervisor to make sure movement to the applicable strike stations occurs.

MATERIALS-HANDLING EQUIPMENT

Efficient use of materials-handling equipment eases the movement of cargo in holds and on decks during replenishment operations. On combatants, the kinds of equipment available and the space available at replenishment stations vary from ship to ship. Transporters, forklift trucks, pallet-type handlift trucks (pallet jacks), hand trucks, dollies, skate wheel or roller conveyors, and other devices are provided to aid the cargo movement to minimize the time and effort required to complete the replenishment operation. Ships cannot properly perform their primary mission while supplies clutter their decks, bays, and passageways. The replenishment operation itself

will be delayed unless receiving areas are kept clear. The replenishment plans for each ship designed to make optimum use of the ship's materials handling must still be performed by manpower, but may use any of the following units of equipment to supplement this effort.

Pallets

The normal procedure is for supplies to be unitized on pallets when delivered aboard combatant ships. Mechanized movement aboard larger ships will generally be done in full unit loads. During strikedown, empty pallets not used for storage should be neatly stacked out of the way of the material flow in preparation for their return to the auxiliary ship. The stacking and return of the pallets may be an individual station responsibility or the responsibility of the entire replenishment evolution. When a station is no longer receiving cargo it is clear to return pallets to the auxiliary. The station should be used for this purpose at the discretion of the cargo officer on the combatant and with consent from the auxiliary to return empty pallets. A reasonable amount of care should be exercised in handling and returning the pallets to the auxiliary since their reuse will result in a considerable savings to the Navy.

Transporter

A transporter is a vehicle designed to receive, carry, and off-load a multiple number of pallets per load. Standard transporters are available with capabilities of carrying four pallets. Transporters are available with various types of conveyor decks capable of loading from a fixed conveyor or from other external sources and capable of off-loading to an external conveyor or other source. Transporters are used for the horizontal movement of cargo on deck and have capabilities of negotiating ramps to carry out transit of cargo between decks. Transporters may be either gasoline- or diesel-powered units. Transporters may also be provided with the capability of lifting loads to perform onloading from a variety of levels.

Forklift Trucks

A forklift truck is a vehicle designed to pick up, carry, and stack palletized loads. Standard forklift trucks are available with lifting capacities from 2,000 to 15,000 pounds and lifting heights from 50 to 210 inches. However, units carried aboard ship are usually in the capacity range of 2,000 to 6,000 pounds. Forklifts are available in gasoline-powered, diesel-powered, or electric-powered models and may be equipped with solid or pneumatic tires. Electric models with solid tires are more commonly used aboard ships. Their use eliminates the danger from carbon monoxide contamination in confined spaces. Forklifts are employed for the horizontal movement of palletized loads on deck and may also be used to transport loads between decks where adequate ramps are provided.

Pallet Jacks

Pallet jacks are available in two designs: the hand-operated, manually propelled model and the electric-powered, hand-operated model. This type of truck is commonly used where a forklift truck may not be operated because of space limitations and where tiering of pallet loads is not required. The electric-powered model is capable of negotiating slight inclines under load but generally this type of equipment is limited to horizontal movement.

Tractors

A tractor may be used for towing loaded trucks or dollies in the horizontal movement of cargo on deck. A tractor has only pulling capabilities so that loading and unloading of trucks or dollies must be done by other means. Tractors may be gasoline-, diesel-, or electric-powered and equipped with either solid or pneumatic tires. Tractors are rated by their drawbar pull capacity.

Trucks and Dollies

Four-wheel trucks and pallet dollies may be available aboard ship for short haul horizontal movement of cargo with manual means or with the aid of a tractor. Two-wheel hand trucks are also available for manually handling material.

Conveyors

A conveyor is a means of transporting cargo from one area to another, either horizontally or vertically, with the aid of wheels, rollers, chain, belt, or other means supported or connected by means of a metal framework. Horizontal movement on deck may be aided by the use of gravity-type wheel or roller conveyors that may be assembled from a number of uniform length straight sections and curves to meet a number of different type situations. Standard sections of either wheel or roller conveyors are available in 5- or 10-foot lengths and curves with 45- to 90-degree turns with provisions for connections at the ends. Both types of conveyor are also available with the top of the rollers or wheels above the supporting frame (rollers high or wheels high) and with the top of the rollers or wheels below the top of the supporting frame (rollers low or wheels low). Standard widths are normally available ranging from 12 inches wide to a maximum of 48 inches. When only narrow widths are available, it is practical to lay two parallel lines with sufficient spacing between to properly accommodate the width of a pallet load without danger of tipping. When used in this fashion, the "rollers high" type of conveyor is necessary. It is more practical to make up temporary arrangements of narrow width units because of the ease in handling lighter weight sections. Standard sections are available in either aluminum or steel. A variety of arrangements of gravity wheel or roller conveyors may be used at the receiving station to quickly move cargo from this area to avoid congestion.

Traylift Conveyors

Vertical movement between decks may be done by means of a vertical traylift conveyor. This type of conveyor uses an endless chain traversing in a vertical direction over sprockets or wheels at the top and bottom with horizontal bars or trays attached to convey the cargo. Where such conveyors are used, cargo is generally deposited on a conveyor ahead of the infeed station that loads the conveyor automatically at predetermined intervals and correspondingly unloads the cargo automatically at the various receiving deck levels. At the unload station there may also be means where the cargo is fed out on a section of conveyor from where it is taken for storage. Such conveyors may be used for movement of palletized or packaged cargo. Where conveyors with pallet-size capabilities are available such loads may be handled by forklift trucks. Where smaller conveyors are available, by necessity, the pallets must be broken down at the upper deck level and the individual cartons fed over the conveyor to the storage level. Ladder chutes or feathering tread ladders may be provided as a means of movement from one deck level to another. Ships that do not have such equipment must devise makeshift arrangements such as sliding boards for movement of material between decks. Such arrangements generally require additional manpower often with slow, unsatisfactory results.

STORAGE ASHORE

Because of the requirement for the fullest use of storage space at the minimum cost, all major ashore supply installations must give due consideration to uniformity within the Department of Defense in the layout of storage areas. Aisle widths are limited to the size required to accommodate the operation of materials-handling equipment needed. Whenever possible, supplies requiring large capacity materials-handling equipment are grouped in separate locations from those requiring smaller capacity equipment.

The structures discussed and illustrated in the following paragraphs indicate the general appearance and functional use of the most common types of storage facilities used by supply activities.

COVERED STORAGE SPACE

Covered storage space is storage space within any roofed structure. Many different types of covered storage space exist. These include general-purpose warehouses, refrigerated warehouses, and flammable storage warehouses.

General-Purpose Warehouse

A general-purpose warehouse is used for the storage of many kinds of items and is constructed with roof, sidewalls, and end walls. Such warehouses normally contain the greater portion of the total available covered storage space at most activities. General-purpose warehouses may be either single-story or multistory buildings.

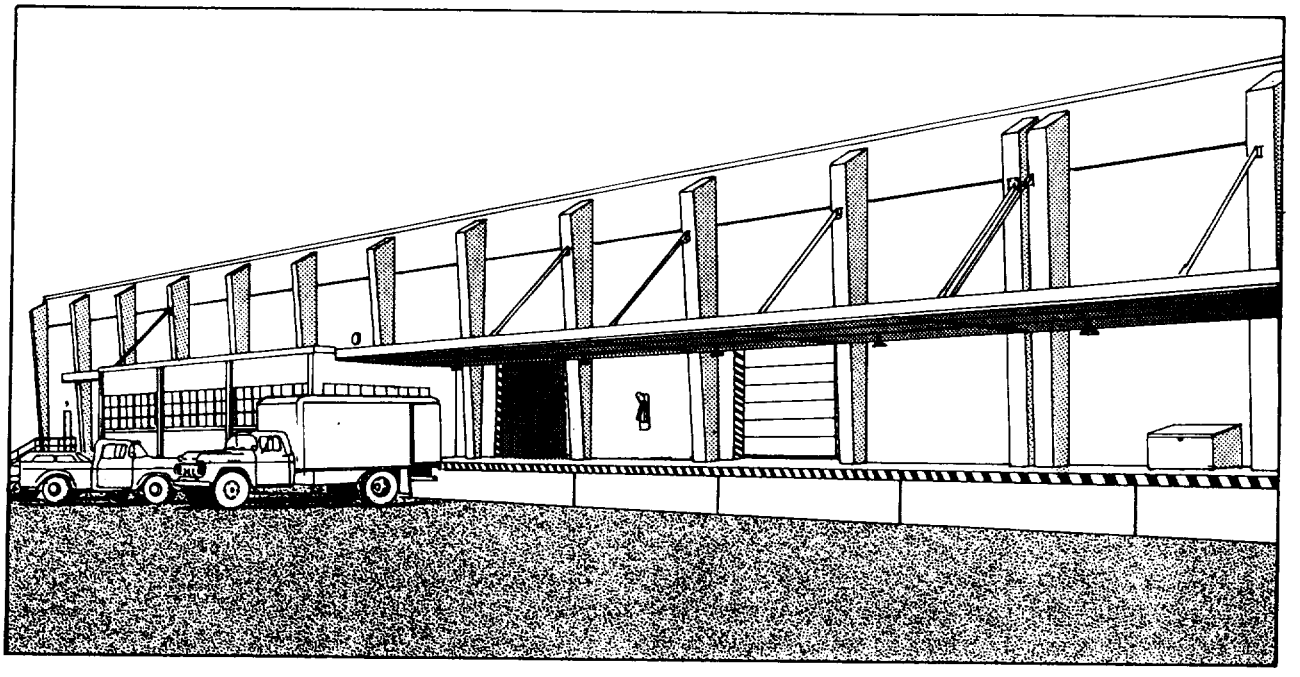

Figure 7-2.—Truckloading platform side of a general-purpose warehouse.

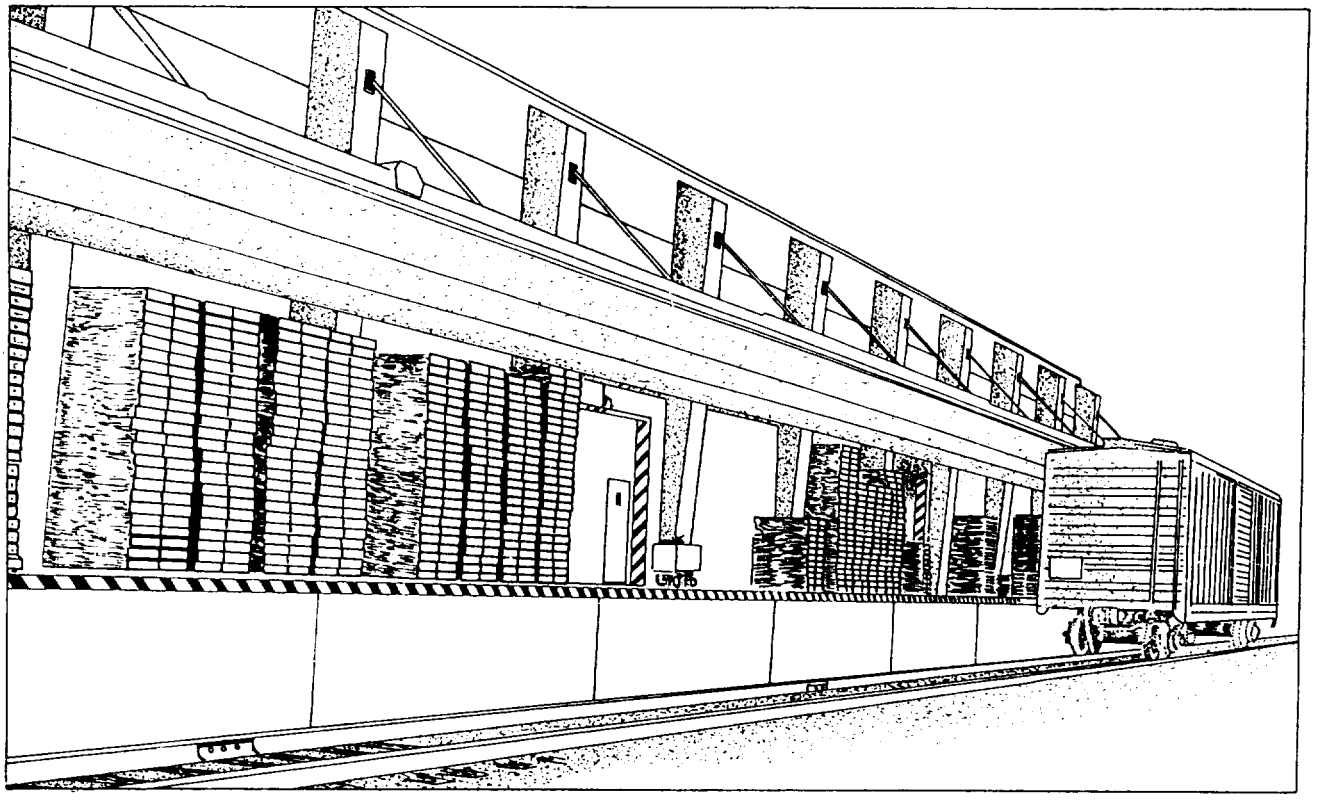

Figure 7-3.—Carloading platform side of a general-purpose warehouse.

Figures 7-2 and 7-3 depict the exterior of an ideal general-purpose warehouse.

Truckloading platforms (fig. 7-2) on one side of the warehouse make sure of efficient handling of truck-hauled materials. Paving at truckloading platforms permits vans to backup to the platform to be loaded or unloaded by materials-handling equipment, which has direct access to the platform through warehouse doors.

A carloading platform runs the full length of the opposite side of the general-purpose warehouse (fig. 7-3) permitting materials-handling equipment to load and unload railcars easily from any warehouse door. Warehouse space is conserved by stacking the pallets on the platform. The canopy provides protection from inclement weather.

Two main aisles extend the length of the general-purpose warehouse allowing materials-handling equipment to move without interruption throughout the building and creating a straight line flow of supplies. Main aisles are connected by cross aisles, which furnish direct access to stacks from both carloading and truckloading platforms.

Figure 7-4 illustrates the interior of the warehouse and the technique of stacking material. Bays may be fitted out with pallet racks and retail bins if desirable. Frequently a combination of stacks, pallet racks, and retail bins is used to accommodate the different material categories contained in an individual warehouse.

Refrigerated Warehouse

A refrigerated warehouse is used for the storage of perishable items. They are usually divided into two distinct areas. One area is designated as a chill space in which the temperature can be controlled between 36° and 46°F. The other space is designated as a freeze space in which the temperature can be controlled at or below a level of 32°F.

Figure 7-4.—Interior of a general-purpose warehouse.

Flammable Warehouse

This type of warehouse is used for the storage of highly combustible materials such as oils and paints. They are built of noncombustible materials and have firewalls with a 4-hour fire resistance rating. Their main dependence for fire protection is placed on an automatic deluge-type sprinkler system connected to an adequate water supply and an alarm reporting system.

OPEN STORAGE SPACE

Open storage space is an improved or unimproved area designated for use in storing material. Open improved storage space is an open area that has been graded and hard surfaced or prepared with a topping of some suitable material to permit effective materials-handling operations. Although covered storage is preferred and necessary for most supplies, materials that are not readily susceptible to damage by adverse weather conditions can be accommodated in open storage. Figure 7-5 illustrates a typical improved open storage space.

Open unimproved storage space is an open area that has not been surfaced for storage purposes. This method of storage is comparatively inexpensive to operate and maintain and is normally used for items that are unaffected by weather conditions. The restriction placed on the use of materials-handling equipment is one of the principal disadvantages of this type of area.

WAREHOUSING

For this discussion of warehousing, the focus will be on those things that the SK normally has some control over; that is, the actual arrangement of the stores. Factors in warehousing such as design, size, and interior characteristics of the warehouse are usually permanent and cannot be changed without extensive alteration.

Planning the Storage Layout

Storage space is the basic resource of any supply department. It is important, therefore, that the use of this storage space should be as efficient as possible. This can be obtained only by planning of storage space. Some of these plans are explained as follows.

SIMILARITY STORAGE.— The basic principle of similarity storage is that, as far as possible, like items should be stored together. For example, all items in group and class 7510 would be stored in the same area; or to take it a step further, all items in group 75. This method of storage has some obvious drawbacks. It does not recognize that some items move faster than others and should be convenient to the breakout area, and it also makes little allowance for the size difference in items within a group. Similarity storage is more often used by supply centers and depots where the number of warehouses would allow this type of storage to be used on a practical basis.

Figure 7-5.—Improved open storage area.

STORAGE BY SIZE.— The principle of storage by size is that the storage or warehouse layout is determined by the size and bulk of the material being stored. In addition to size and bulk, some factors to be considered are the anticipated stock level for an item, the frequency of receipt and issue, and the difficulty in moving the item. Storing items by size does not always permit the fast-moving items to be closest to the issue point.

POPULARITY STORAGE.— In popularity storage, the items with the highest turnover rate are stored as close as possible to the receipt and breakout point. Figure 7-6 illustrates this method of storage. Popularity storage is generally considered the best method of storage since it allows quick access to fast-moving stores. Experience and conditions show that a combination of the various methods of storage will better suit your needs.

STORAGE DETERMINED BY MATERIAL CHARACTERISTICS.— The material characteristics of some items make it necessary to provide special storage areas for them. Two examples of this are hazardous materials, which must be stored in an area where the material hazard is controlled or eliminated, and pilferable items, which must be stored in buildings or areas where security for the items can be maintained.

WORK AREAS.— The storage layout of a warehouse should contain provisions for an office and work area. This space should be kept to a minimum and not exceed an area larger than that required to handle an average workload. The office and work area should be located as close as possible to the main access door of the warehouse.

Aisles

One of the most important features of good warehousing is aisle arrangement. Five types of aisles are used in Navy warehouses: main, cross, personnel, fire, and service.

MAIN AISLES.— The main aisles serve as the lifeline or arteries of a warehouse. Main aisles generally run the length of the building and should be kept clear at all times. They are located so that they give direct access to shipping and receiving platforms, doorways between sections, and in multistory buildings they give access to elevators and conveyors. The number of main aisles in a section or on a floor of a multistory building depends on the number of communicating doors and elevators required to move material in and out of the area. The number of main aisles is also determined somewhat by the size of the lots and

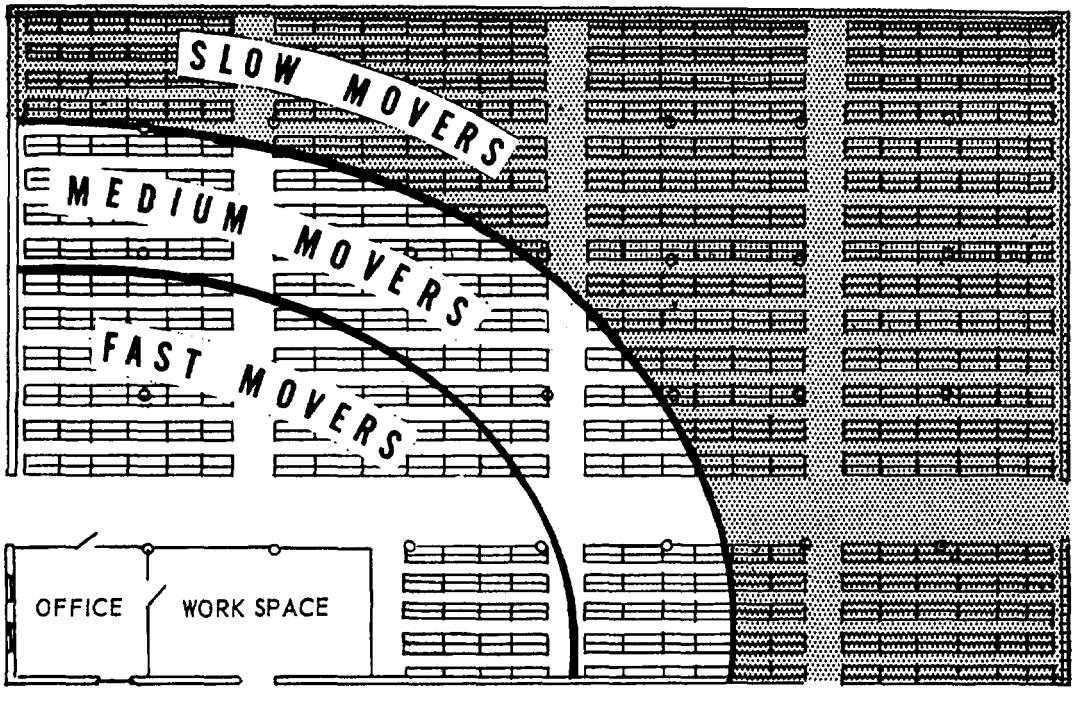

Figure 7-6.—Popularity system of storage.

the number of different commodities. In a section where one item fills the entire area, the section should be stacked to its capacity, leaving only enough space to "get at" it and permit access for fire prevention or fire-fighting purposes.

CROSS AISLES.— Cross aisles are passageways at right angles to main aisles. At least two cross aisles are needed in the standard warehouse section. Where possible, cross aisles should be laid out so that they will lead directly to opposing doors of the warehouse. Most storage operations are carried on in the cross aisles.

PERSONNEL AISLES.— Personnel aisles are those used as pedestrian routes only. Personnel aisles should be held to a minimum. Too many deprive you of valuable storage space and at the same time encourage pilferage since they are usually secluded.

FIRE AISLES.— Fire aisles are necessary in every depot or storage activity, but should be kept to a minimum in number and width, since they waste valuable storage space. It is seldom necessary to have fire aisles wider than 24 inches. In many cases they can be eliminated by a simple change in the location of fire-fighting apparatus. Fire aisles must be adjacent to windows that can be used by firemen to gain entrance.

SERVICE AISLES.— Services aisles are normally used for only special commodities of material. They provide access to the interiors of stacks for protective processing, inventory, and inspection.

Direction of Storage

Use of the fork truck and pallet system makes direction of storage a significant factor in space use. Selection of the proper direction of storage can be invaluable in providing a variety of bay sizes without increasing the number of working aisles. At the same time, such planning tends to spread the volume of traffic equally over all working aisles, relieving congestion. This concept is illustrated by the diagrams in figure 7-7 that develop layout in respect to direction of storage for a bay 80 square feet, a typical bay for large-lot storage in a standard warehouse. Using standard 48- by 48-inch pallets, about 17 pallets can be stored in each direction.

Single Item Stored Aisle to Aisle

The simplest but most inflexible disposition of storage space is storage of a single item aisle to aisle shown by part A of figure 7-7. This layout makes no provision for storage of small lot items, which practically every warehouse has.

Miscellaneous Commodities

Numerous articles are shipped in bales and consequently should be stored in the same manner. Some are baled even and solid; others are irregular and slack. The size of the bale varies with the commodity. Be careful not to break the strapping. One broken strap on tightly compressed bales will put extra strain on the other straps and may cause the bale to break open. Firm bales can be palletized and piled as safely as cases. Slack bales that cannot be palletized should be tiered and tied in with dunnage.

Various commodities such as flour and sugar are shipped in burlap or waterproof paper containers. Nails, bolts, or sharp edges should be eliminated in areas where bagged goods are to be stored. If these hazards cannot be removed, the bags should be protected with dunnage. If a bag is broken, it should be plugged with a piece of paper and sewn.

Bags containing perishables or "subject to taint" commodities should be stored on clean, dry dunnage or pallets. Use separating paper with such commodities. Keep them away from odorous commodities—tarred rope, for example.

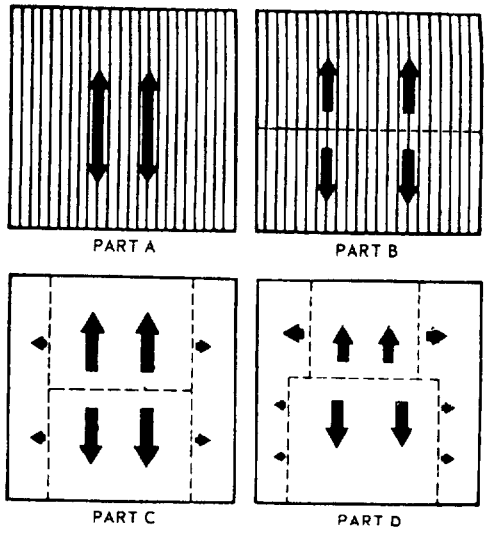

Figure 7-7.—Principles of working aisle arrangements.

Barrels and drums may contain liquids such as gasoline, oil, or syrup, or solids such as asphalt, hardware, and resin. Rough handling or dropping may break in heads or staves. Striking with a hard object such as the fork of a hand truck or bumping with a forklift truck or tractor can puncture drums. A designated space, usually a special building, should be set aside for drums that contain flammable material.

Barrels and drums may be palletized, but weight should be evenly distributed. A 4- by 6-foot board takes six drums. If tiered end up (without the use of pallets), each tier should be separated by strips of dunnage.

Corrosive, poisonous, and flammable liquids are packed in glass carboys or cans. A separate building or warehouse is usually set aside for this type of cargo because it requires special care in handling. The possibilities of damage or disaster arise when this type of material becomes mixed with other types.

Lumber is shipped and stored in all sizes and lengths. It is classed as dry or wet. Dry lumber must be kept dry, but wet lumber may be stored in the open. Hand hooks should not be used on the ends. When slinging, edges must not be gouged with slings, as this may ruin the pieces for the use for which they were intended. Manpower will be conserved if lumber stacks are first built to be handled by a lift or straddle truck. If this is not practical when stacking, build the stack so that it can be taken down by a fork truck. Some lumber because of its small size needs considerable stripping. Laths are good for this purpose. When the stack is built up to a fork truck load, place the blocking so that it acts as stripping and another load can be built on top.

Because piling is round, it is easily handled by rolling with a peavey or canthook. As the butts of piles are larger in diameter than the tops, they should be staggered when tiered. This maintains the same height at each end of the tier. Securely chock the bottom tier to prevent rolling; strip with 4-by 4-inch lumber. Nail chocks to this stripping; the front chock being nailed in place after the completion of the tier. Succeeding tiers are built in a like manner.

Some pipe is made of cast iron, which may break easily if struck a sharp blow. Other pipe must be protected from rust, which means that extra care must be taken to protect it from moisture. Some pipe is coated with an asphalt preparation that becomes soft when exposed to heat, so it must be kept clear of other commodities. Most pipe is too long to store on pallets. It can usually be transported by fork trucks or rolling. Long pipe is tiered in the same manner as piling.

THE SAFETY PROGRAM

The major causes of accidents are carelessness, inexperience, and attitude. The goal of a good safety program should be the elimination of these causes. Whereas an effective training program can overcome the inexperience factor, carelessness and attitude can only be overcome by constant vigilance, stern enforcement of safety regulations and, most importantly, the supervisor's enthusiasm in selling safety to subordinates.

In addition, the critique is an important part of the safety program. It should be held a few days after replenishment and should be attended by as many of the crew in the department as possible and all officers and petty officers taking part or observing should stand up and give their views. Any unsafe practices or potentially dangerous situations that were observed should be brought up at this time. Recommendations for improvement should be discussed on the spot and, if adopted, recorded for later use. A special file should be maintained in the supply office to make sure valuable lessons learned the hard way are not lost.

Recommendations for correcting unsafe conditions that require action by shore activities (inventory managers, supply centers, supply depots, and so forth) should be sent to the activity concerned and to the Naval Supply Systems Command via official channels. Prompt submission of such reports contributes to Navywide safety programs.